

BIRDS AND HUMAN DISEASE

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CONSIDERING the abundance of birds, both domestic and wild, one is astonished to realize that they play so small a rôle in human medicine. The mammals with which man is closely associated frequently share their diseases with him—in fact it is sometimes a matter of sharing in both directions: were either man or his mammalian companions to cease existing, some parasites would automatically become extinct. This is true, for example, of the beef tapeworm, for which man is the only known final host and for which cattle are the only intermediate hosts.

But with birds the situation is entirely different. There are but a few instances in which an avian host is essential to the maintenance of organisms that are capable of infecting man. In some other cases birds divide the capacity of acting as disease carriers with mammals in the same environment, thus merely enlarging the scope of the total reservoir. Generally, however, birds appear to be immune to the creatures that cause human ills, and man likewise is barren ground for would-be invaders from birds. No one can guess how many mosquitoes, laden with infective sporozoites of avian malaria, have bitten human beings—yet there is not a case on record of bird malaria infection in man. Nor has human malaria been encountered in birds.

From the physiological standpoint it is not so amazing after all to contemplate this apparent chasm preventing cross-infection between birds and man. Phylogenetically birds are closely related to reptiles, while a vastly nearer bond unites man with other mammals. But it would be hard to define just what the physiological differences are, since it is difficult to imagine why the warm circulating bloods of a bird and a bat should be individually so unique as to be welcomed by a parasite in one case and repudiated by it in the other. If, however, host specificities exist even among the mammals themselves (and they do, often with sharp distinction), it must be natural for a much wider gap to obtain between mammals and birds. It is this biological discrepancy, seemingly, that results in the small list of diseases common to birds and the human race.

To begin the discussion, it would perhaps be best to mention the general "medical" effects of birds in man's environment. The avian army's war on insects has been mentioned so often in connection with agricultural topics that its controlling activities against arthropod carriers of disease may have been neglected. The numbers of yellow fever mosquitoes or dysentery-carrying house flies consumed by birds can never be estimated, although they are undoubtedly significant. No one is to blame for the oversight, since it is usually impossible to appraise such situations.

"Usually." There is an interesting example, however, that makes necessary the use of the qualifying adverb. In Egyptian hieroglyphic writings the sacred ibis plays a prominent part in the religious ceremonies of the people. Apparently the bird achieved its position of veneration through the astute observation of the Nile inhabitants that tributaries on which ibises could be found were healthful places for human beings: No ibises, poor health.

Such things smack of folk-lore and superstition, but a modern scientific explanation has justified the 5000-year-old myth. Ibises are famous snail-eaters, and it is obvious that where these birds are common, the snail population will be reduced. It so happens that in the Nile Valley two forms of the disease called schistosomiasis exist in endemic form. Schistosomiasis is an infection of the small veins of certain abdominal viscera by blood flukes, the schistosomes. Eggs of these flatworms are discharged in urine or feces of infected individuals, and the eggs, upon reaching fresh water, hatch into primary larvae that bore into the bodies of certain snails. After a period of larval development in these intermediate hosts, asexual multiplication results in the liberation of clouds of secondary larvae. If a human being now bathes in the water, or merely wades in to fill a vessel, he is attacked by the secondary larvae which penetrate his skin, invade the blood stream, and finally mature as adult flukes in his abdominal venules. The Egyptians would have been fully aware of schistosomiasis areas, but the wonder of it is that they made the connection between ibises and freedom from disease.

Ordinarily no such nice demonstration of birds' asset to the environment is possible. Modern human populations being so mobile, so destructive to the natural environment, and so disquieting to bird economy, those balances that exist are constantly being disturbed, and practically the only way one can observe a balance of nature is from the standpoint of the degree of its departure from equilibrium. The vultures along highways in the southern United States seem almost conditioned to the abundance of hog and cattle carcasses in "open range" districts; here they continue to be of use in consuming carrion. But could one draw a conclusion comparable to the one involving sacred ibises? There is nothing implicit in the vulture-automobile situation except that cars have been bumping into cows for the past few decades.

Vultures, and birds of prey that kill live quarry, may serve as disseminators of fleas and other ectoparasites capable of infecting man with such diseases as plague, tularemia, and Rocky Mountain spotted fever. It is possible that they also spread anthrax spores from diseased carcasses.

The question of migration as a means of introducing exotic diseases has been voiced occasionally, but as yet there is no knowledge of trans-continental or trans-hemispheric spread of human infections by migrating birds.

In a few specific cases, however, one can pin birds down as real biological reservoirs of diseases of mankind. Several forms of encephalitis may be the

most common and important examples, although some less significant diseases have received wider publicity. The encephalitides, including St. Louis encephalitis, Japanese B encephalitis, and eastern and western equine encephalomyelitis, are virus diseases affecting man, other mammals, and birds. They are transmitted chiefly by mosquitoes. Their status at present is hard to define, since new virus modifications are being discovered with great rapidity; moreover the list of bird hosts is increasing with almost equal speed.

The part birds take in this scheme is apparently related to a typical epidemiological series of events. At the beginning of the breeding season there are many immune adult birds and few susceptible ones, due to exposure and infection of the majority during the previous year. There are therefore few virus carriers. In addition the mosquito population is at a low ebb, there being few individuals available to serve as transmitters. As the season progresses, mosquito-breeding advances rapidly, so that before long there are: (1) an entire new population of susceptible birds and (2) a swarm of new mosquitoes ready for the business of virus transmission. Hence within a few months encephalitis virus is widespread in the environment, reaching its peak about August. The human disease appears at this time, as a "spill-over" from the bird-mammal epizöotic, and continues until frost does away with most of the mosquitoes.

Ornithosis—a form of atypical pneumonia or virus pneumonia—is one of the publicized recent medical discoveries. It has been found that semi-wild pigeons in large cities are sometimes naturally infected with the causative virus, and it seems on epidemiologic grounds that they may be the source of occasional human infections. One large eastern city became so concerned with the problem that it passed an ordinance forbidding the feeding of pigeons in public parks. It took the pluck of an elderly lady to test the strength of the prohibition: she was caught, blatantly gorging pigeons on peanuts, and her trial made the front pages of the newspapers. Meanwhile young sympathizers equally blatantly strolled through the parks with bags of cracked corn—bags with large holes in them, although the strollers of course had no idea of such defects. The pigeons have fared well through their public supporters.

The host range of ornithosis virus among birds is only partially known. A signal point of its prevalence is in birds of the parrot-parakeet-macaw group, where the disease is called psittacosis. A respiratory malady transmitted as an airborne infection directly from sick birds to human beings, it is responsible for present quarantine regulations against the importation of psittacine birds from South America. Foci of psittacosis in aviaries of parrots or love birds already in this country are stamped out as soon as detected.

The obscure disease, toxoplasmosis, probably of protozoan etiology, is being recorded from a growing list of mammals and birds. Nothing is known of its transmission, although human infants born of infected mothers have died of

its effects on the central nervous system. As widespread as toxoplasmosis is, it will probably not be too long before some research group gives leading information on the subject, and then it will be possible to state whether avian *Toxoplasma* organisms and the ones infecting mammals are one and the same.

Swimmer's itch, finally, is an ill attributable directly to birds in some instances. As in the case of the Egyptian blood flukes, a combination of warm-blooded hosts, snails, and schistosomes is involved. But in this example the final host is a teal or muskrat. The human bathers in a Wisconsin lake or neighboring resort waters who encounter secondary worm larvae, find themselves covered with itching welts that may become encrusted and infected. Not only do the victims regret the situation; the worm larvae, attracted only by the stimulus of a warm-blooded skin, die as a consequence of their entry into a wrong host. For here again is the formula of host specificity: a schistosome of teals cannot mature in man. After causing the people sufficient pruritic agony and bewilderment, the larvae die. Eventually the superficial dermatitis terminates with the sloughing of a final crusted scale.

A consideration of the relation between birds and human disease should not be concluded without mention of the place of birds in medical research. For a number of years canaries and ducks have been used extensively in malaria research. At present the barnyard chicken is emerging as the darling of medical science—not by its proud male struttings, but by the triumphal cackling of the hen that lays a fertile egg. One can hardly conceive of the use to which fertile eggs may be put ultimately, when one scans what is being done at present. Incubated eggs, inoculated with various viral and rickettsial (typhus-like) agents, have recently provided vaccines in sufficient abundance to protect entire populations of human beings against diseases that were formerly not to be combated. The lowly egg, previously valued chiefly at breakfast, has become the greatest tissue-culture vehicle ever imagined.

Suspensions or extracts of various tissues of embryonated hens' eggs yield materials useful either as vaccines in immunizing human beings and domestic animals against disease, or as antigens in performing laboratory tests for the diagnosis of the same diseases. Heretofore these products were available in extremely low abundance, sometimes even obtained by the painstaking dissection of the digestive tracts of infected lice and ticks.

Eggs are being used currently also as media for the growth of all sorts of foreign tissues. They may therefore afford a new avenue for cancer investigators.

Thus it can be seen that some birds are doing their best to atone for the disease-spreading activities of their less considerate relatives. Since the score against birds is a very small one anyhow, one may suggest that the wrong has already been over-compensated.